

Appendix A. Known Structures Within CALFED ERP Geographic Scope

COUNTY	River Name	Barrier Name	Description	Latitude	Longitude
ALAMEDA	Alameda Creek	Sunol Dam	Dam	37.5945008	-121.9009022
	Alameda Creek	Alameda Creek Diversion Dam	Diversion	37.497	-121.7798
	Alameda Creek	Concrete Swim Dam #2	Dam	37.5114	-121.8250
	Alameda Creek	USGS Gauging Station Apron	Apron	37.5869437	-121.9601558
	Alameda Creek	Alameda Creek Road Crossing	Road	37.598	-121.938
	Alameda Creek	BART Weir	Weir	37.5685500	-121.9877836
	Alameda Creek	Armored Gas Line Crossing	Pipeline	37.576	-121.872
	Alameda Creek	Upper Inflatable Dam	Inflatable Rubber Dam	37.5730	-121.9705
	Alameda Creek	Lower Inflatable Dam	Inflatable Rubber Dam	37.5658	-121.9958
	Alameda Creek	Upper Alameda Weir	Weir	37.559	-121.865
	Alameda Creek	Concrete Swim Dam #1	Dam	37.5133	-121.8264
	Alameda Creek	Niles Dam	Dam	37.5862	-121.9617
	Alameda Creek	Middle Inflatable Dam	Dam	37.569	-121.9869
	Arroyo Del Valle	Del Valle	Earth	37.615	-121.745
	Arroyo Mocho	Drop Structure #1	Unknown	37.677	-121.910
	Arroyo Mocho	Drop Structure #2	Drop Structure	37.68	-121.788
	Arroyo Mocho	Road To Pumping Station	Road	37.583	-121.622
	Calaveras Creek	Calaveras	Hydraulic Fill	37.492	-121.82
	San Antonio Creek	James H. Turner	Earth	37.573	-121.848
	San Leandro Creek	Chabot	Hydraulic Fill	37.73	-122.122
	San Leandro Creek	New San Leandro	Earth	37.763	-122.095
	San Lorenzo Creek	Concrete Channel	concrete		
	San Lorenzo Creek	Don Castro	Dam	37.6922	-122.0577
	San Lorenzo Creek	Cull Canyon	Dam	37.704	-122.0538
	Stonybrook Creek	Palomares Road Culvert	Culvert	37.6099	-121.943
	Temescal Creek	Lake Temescal	Earth	37.848	-122.23
AMADOR	Dry Creek Tributary	Arroyo Seco	Earth	38.355	-120.998
	Jackson Creek	Jackson Creek	Earth & Rock	38.303	-120.888
	Little Indian Creek Tributary	Plymouth	Earth	38.475	-120.882
	Mule Creek Trib	Preston	Earth	38.368	-120.937
	Murphy Creek	Sparrowk Dam	Dam	38.2343	-121.0256
	Murphy Creek	road crossing	Road	38.2287	-121.0287
	Pigeon Creek	Shenandoah Lake	Earth	38.533	-120.813
BUTTE	Big Chico Creek	Bear Hole	Natural	39.7769	-121.7497
	Big Chico Creek	Five-Mile Dam	Diversion	39.762	-121.791
	Big Chico Creek	Higgins Hole	Natural	39.890	-121.694
	Big Chico Creek	Iron Canyon	Natural	39.784	-121.739
	Big Chico Creek	Irrigation Dam	Irrigation Dam	39.887	-121.670
	Big Chico Creek	Lindo Channel Weir And Culvert	Weir	39.762	-121.792
	Big Chico Creek	One-Mile Dam	Dam	39.735	-121.829
	Big Chico Creek	Sycamore Weir	Weir	39.762	-121.791
	Butte Creek	Adams Dam	Diversion	39.623	-121.773
	Butte Creek	Butte Creek Head Dam	Hydro Diversion	39.982	-121.588
	Butte Creek	Butte Slough Outfall	Gates	39.195	-121.935
	Butte Creek	Centerville Head Dam	Dam	39.867	-121.632
	Butte Creek	Drumheller Slough	Culvert	39.290	-121.923
	Butte Creek	Durham Mutual Dam	Dam	39.702	-121.775
	Butte Creek	Forks Of Butte Dam	Hydro Diversion	39.915	-121.614
	Butte Creek	Gorill Dam	Dam	39.603	-121.784
	Butte Creek	Natural Barrier	Natural	39.857	-121.633
	Butte Creek	Parrott-Phelan Dam	Dam	39.710	-121.749
	Butte Creek	White Mallard Dam	Weir	39.332	-121.903
	Butte Creek	White Mallard Outfall	Weir	39.309	-121.916
	Feather River	Fish Barrier Dam	Dam	39.521	-121.546
	Feather River	Oroville Dam	Hydro Diversion	39.545	-121.493
	Feather River	Thermalito Diversion Dam	Dam	39.529	-121.543
	Sanborn Slough	End Weir	Weir	39.326	-121.881
	Sanborn Slough	North Weir	Weir	39.336	-121.891
CALAVERAS	Wadsworth Canal	Wadsworth Canal	Weir	39.154	-121.733
	Dry Creek 2 Trib	Mccarty Dam	Dam	38.027	-120.69
	Stanislaus River	Gravel Pit 13	Pits	37.844	-120.643
	Stanislaus River	Gravel Pit 14	Pits	37.862	-120.632
	Stanislaus River	Gravel Pit 15	Pits	37.852	-120.637
	Calaveras River	Dam	Dam	38.148	-120.824
	Calaveras River	Road	Road	38.0752	-120.8838
	Calaveras River Trib	Bevanda	Earth	38.142	-120.883
	Carson Creek Trib	Stevenot	Earth Dam	38.035	-120.498
	Esperanza Creek	Reid	Earth Dam	38.298	-120.45
	Little Johns Creek	Copper Cove	Earth Dam	37.908	-120.625

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COUNTY	River Name	Barrier Name	Description	Latitude	Longitude
	Penney Creek	Copperopolis	Earth & Rock Dam	37.983	-120.648
	Stanislaus River	Goodwin	Multiple Arch	37.863	-120.628
	Stanislaus River	New Melones	Earth & Rock Dam	37.948	-120.525
	Stanislaus River	Tulloch	Gravity	37.875	-120.603
COLUSA	Bear Creek Trib	Rancho Rubini	Earth	39.197	-122.418
CONTRA COSTA	Butte Creek	Tarke Weir	Weir	39.234	-121.944
	Bear Creek	Briones	Earth	37.913	-122.208
	Dry Creek	Dry Creek	Earth	37.912	-121.733
	Grayson Creek	Clearwell Phase 2	Earth	38.005	-122.070
	Lafayette Creek	Lafayette	Earth	37.885	-122.138
	Marsh Creek	Reservoir	Dam	49.627	-120.600
	Marsh Creek	Drop structure	Drop structure	37.89	-121.723
	Marsh Creek Trib	Sand Creek Drop	Diversion	37.892	-121.725
	Old River Trib	Clifton Court Forebay	Earth	37.83	-121.547
	San Pablo Creek	San Pablo	Earth	37.943	-122.260
	Unnamed Stream	Santos	Earth	37.858	-121.670
	Wildcat Creek	C. L. Tilden Park	Earth	37.897	-122.25
EL DORADO	Deer Creek	Cameron Park	Earth	38.682	-120.99
	Deer Creek Trib	Crystal Lake	Earth	38.672	-121.633
FRESNO	Fancher Creek	Fancher Creek Dam	Dam	36.800	-119.525
	Fresno Slough	Mud	Earth Dam	36.563	-120.167
	Hildreth Creek Trib	Fancher Creek Dam	Dam	37.062	-119.822
	Holland Creek Trib	Griffen Reservoir Dam	Dam	36.807	-119.44
	Kings River	Alta Main Canal	Diversion	36.799	-119.394
	Kings River	Black Rock Reservoir	Dam	36.9195	-119.0217
	Kings River	Consolidated Canal	Diversion	36.762	-119.401
	Kings River	Dutch John Cut	Diversion	36.452	-119.617
	Kings River	James Bypass	Levees	36.521	-120.059
	Kings River	Murphy Slough 1	Dam	36.401	-119.669
	Kings River	Murphy Slough 2	Dam	36.436	-119.673
	Kings River	Murphy Slough Drop Structure	Drop Structure	36.468	-119.971
	Kings River	Pine Flat	Gravity	36.832	-119.325
	Kings River Trib	Reynolds Weir	Weir	36.435	-119.67
	Kings River Trib	Stinson Weir	Flashboard & Buttress	36.46	-119.992
	Little Panoche Creek	Little Panoche Detention Dam	Dam	36.8	-120.783
	Redbank Creek	Redbank Detention Dam	Dam	36.81	-119.58
	San Joaquin River	Big Dry Creek	Earth Dam	36.868	-119.67
	San Joaquin River	Cal Mat Diversion	Irrigation Diversion	36.905	-119.779
	San Joaquin River	Cobbs Island	Road	36.911	-119.768
	San Joaquin River	Delta Mendota Canal	Diversion	36.781	-120.371
	San Joaquin River	Friant Kern Canal Access Road	Road	36.943	-119.678
	San Joaquin River	Gravel Pit 03	Pits		
	San Joaquin River	Gravel Pits	Diversion	36.933	-119.739
	San Joaquin River	Helm Ditch	Diversion	36.786	-120.372
	San Joaquin River	Island 1	Road	36.858	-119.811
	San Joaquin River	Ledger Island	Road	36.944	-119.737
	San Joaquin River	Lift Canal	Diversion	36.778	-120.369
	San Joaquin River	Main Canal	Diversion	36.786	-120.373
	San Joaquin River	Mendota Diversion	Flashboard & Buttress	36.788	-120.372
	San Joaquin River	Outside Canal	Diversion	36.778	-120.369
	San Joaquin River	Sack Dam	Diversion	36.984	-120.499
GLENN	Stony Creek	North Diversion Dam	Diversion	39.798	-122.262
	Stony Creek	Stony Gorge	Dam	39.586	-122.531
	Stony Creek	Tehama-Colusa Canal Turnout Structure	Diversion	39.763	-122.155
KINGS	Kings River	Army Weir	Flashboard & Buttress	36.388	-119.788
	Kings River	Crescent Weir	Flashboard & Buttress	36.387	-119.877
	Kings River	Island Weir	Flashboard & Buttress	36.388	-119.788
	Kings River	Last Chance Weir	Flashboard & Buttress	36.42	-119.667
	Kings River	Lemoore Diversion Weir	Flashboard & Buttress	36.418	-119.722
	Kings River	Peoples Weir	Flashboard & Buttress	36.487	-119.535
LAKE	Cache Creek	Clear Lake Impoundment	Gravity	38.923	-122.565
MADERA	Chowchilla River	Buchanan	Earth & Rock Dam	37.217	-119.983
	Chowchilla River	Sierra Vista	Earth Dam	37.152	-120.276
	Coarse Gold Creek	Black Hawk Dam	Dam	37.163	-119.783
	Fresno River	Hidden	Earth Dam	37.11	-119.883
	Fresno River	Madera Lake Dam	Dam	37.018	-119.995
	Hildreth Creek Trib	Lake Jane Dam	Dam	37.062	-119.822
	Longhollow Creek	Spring Creek Dam	Dam	37.182	-119.768
	San Joaquin River	Berenda Slough	Earth Dam	37.128	-120.188
	San Joaquin River	Chowchilla Canal Bypass	Diversion	36.774	-120.284
	San Joaquin River	Columbia Canal	Diversion	36.788	-120.354
	San Joaquin River	Frontage Road (99)	Road	36.843	-119.932
	San Joaquin River	Gravel Pit 1	Pits	36.867	-119.807
	San Joaquin River	Gravel Pit 2	Pits	36.866	-119.803

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COUNTY	River Name	Barrier Name	Description	Latitude	Longitude
	San Joaquin River	Gravel Pit 3	Pits	36.863	-119.808
	San Joaquin River	Gravel Pit 4	Pits	36.861	-119.811
	San Joaquin River	Gravel Pit 5	Pits	36.860	-119.807
	San Joaquin River	Gravel Pit 6	Pits	36.855	-119.809
	San Joaquin River	Gravel Pit 7	Pits	36.856	-119.808
	San Joaquin River	Gravel Pit 8	Pits	36.857	-119.808
	San Joaquin River	Gravel Pit 9	Pits	36.853	-119.810
MADERA	San Joaquin River	Gravel Pit 10	Pits	36.851	-119.814
	San Joaquin River	Gravel Pit 11	Pits	36.851	-119.819
	San Joaquin River	Gravel Pit 12	Pits	36.854	-119.858
	San Joaquin River	Gravel Pit 13	Pits	36.850	-119.866
	San Joaquin River	Gravel Pit 14	Pits	36.851	-119.869
	San Joaquin River	Gravel Pit 15	Pits	36.851	-119.875
	San Joaquin River	Gravel Pit 16	Pits	36.858	-119.888
	San Joaquin River	Gravel Pit 17	Pits	36.852	-119.902
	San Joaquin River	Gravel Pit 18	Pits	36.847	-119.910
	San Joaquin River	Gravel Pit 19	Pits	36.846	-119.920
	San Joaquin River	Gravel Pit 20	Pits	36.848	-119.925
	San Joaquin River	Gravel Pit 21	Pits	36.841	-119.934
	San Joaquin River	Gravel Pit 22	Pits	36.836	-119.938
	San Joaquin River	Gravel Pit 23	Pits	36.835	-119.948
	San Joaquin River	Gravel Pit 24	Pits	36.836	-119.958
	San Joaquin River	Gravel Pit 25	Pits	36.835	-119.959
	San Joaquin River	Gravel Pit 26	Pits	36.834	-119.955
	San Joaquin River	Gravel Pit 27	Pits	36.834	-119.962
	San Joaquin River	Gravel Pit 28	Pits	36.836	-119.976
	San Joaquin River	Gravel Pit 29	Pits	36.838	-119.976
	San Joaquin River	Gravel Pit 30	Pits	36.858	-119.811
	San Joaquin River	Island 2	Road	36.852	-11.8125
	San Joaquin River	Island 3	Road	36.853	-119.814
	San Joaquin River	Madera Canal	Canal	36.786	-120.373
	San Joaquin River	Mendota Dam	Dam	36.8	-120.4
	San Joaquin River	Road	Road	36.833	-119.965
	San Joaquin River	San Joaquin Control Structure	Flood Control Dam	36.774	-120.284
MARIN	Novato Creek	Novato Creek	Earth	38.112	-122.637
	Salmon Creek	Dolcini	Earth	38.16	-122.698
	San Antonio Creek Trib	Vonsen	Earth	38.182	-122.685
MARIPOSA	Bear Creek	Bear Creek Dam	Earth Dam	37.37	-120.228
	Horse Creek Trib	Hendricks Dam	Dam	37.357	-119.892
	Mariposa	Mariposa	Earth Dam	37.291	-120.146
	Merced River	Mcswain	Earth & Rock Dam	37.522	-120.309
	Owens Creek	Owens Creek Dam	Earth Dam	37.314	-120.185
MERCED	Bear Creek	Bravel Slough	Diversions	37.258	-120.792
	Bear Creek	Crocker Dam	Dam	37.312	-120.531
	Bear Creek	Deep Slough 1	Diversions	37.225	-120.767
	Bear Creek	Deep Slough 2	Diversions	37.225	-120.767
	Burns Creek	Burns	Earth Dam	37.377	-120.275
	Canal Creek	Castle	Earth Dam	37.404	-120.543
	Dry Creek	Kelsey	Earth Dam	37.544	-120.358
	Dry Creek South Fork	Kelsey Dam	Dam	37.543	-120.355
	Los Banos Creek	Los Banos Detention Dam & Reservoir	Dam	37	-120.93
	Merced River	Bettencourt	Pits	37.467	-120.599
	Merced River	Cressey Pit	Pits	37.428	-120.676
	Merced River	Crocker Diversion	Gravity	37.515	-120.37
	Merced River	Dam	Dam	37.513	-120.445
	Merced River	De Micheli Pit	Pits	37.435	-120.651
	Merced River	Diversion Dam	Dam	37.496	-120.465
	Merced River	Diversion Dam	Dam	37.513	-120.445
	Merced River	Gravel Pit 1	Pits	37.427	-120.671
	Merced River	Gravel Pit 10	Pits	37.470	-120.542
	Merced River	Gravel Pit 2	Pits	37.444	-120.642
	Merced River	Gravel Pit 3	Pits	37.443	-120.636
	Merced River	Gravel Pit 5	Pits	37.461	-120.605
	Merced River	Gravel Pit 6	Pits	37.469	-120.596
	Merced River	Gravel Pit 7	Pits	37.469	-120.585
	Merced River	Gravel Pit 8	Pits	37.471	-120.585
	Merced River	Gravel Pit 9	Pits	37.470	-120.566
	Merced River	Ingalsbe Slough Dam	Dam	37.518	-120.436
	Merced River	Magnusen Pit	Pits	37.439	-120.645
	Merced River	Merced Falls	Gravity	37.522	-120.328
	Merced River	River Rock No. 1	Pits	37.468	-120.507
	Merced River	River Rock No. 4	Pits	37.452	-120.612
	Merced River	Road	Road	37.471	-120.566
	Merced River	Road	Road	37.470	-120.565

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COUNTY	River Name	Barrier Name	Description	Latitude	Longitude
	Merced River	Robinson South	Pits	37.475	-120.496
	Merced River	Robinson Tailings	Unknown	37.481	-120.483
	Merced River Trib	Lake Yosemite Dam	Dam	37.372	-120.437
	Mustang Creek	Mustang Creek	Earth Dam	37.503	-120.66
	Owens Creek	Monnett	Dam	37.251	-120.479
	Owens Creek	Puglizevich	Dam	37.263	-120.458
	San Joaquin River	Cascade Dam	Hydro Diversion		
	San Joaquin River	Eastside Bypass	Diversion	37.259	-120.763
	San Joaquin River	Mariposa Bypass	Diversion	37.204	-120.692
	San Joaquin River	Mariposa Bypass Drop Structure	Unknown	37.202	-120.756
	San Joaquin River	Sand Slough Control Structure	Diversion	37.113	-120.589
NAPA	Angwin Branch	Henne	Earth	38.587	-122.46
	Angwin Creek	Orville	Earth	38.588	-122.463
	Angwin Creek Trib	Deer Lake	Earth	38.597	-122.472
	Carneros Creek Trib	Scotts Canyon	Earth	38.297	-122.362
	Carneros Creek Trib	Wine Lake	Earth	38.258	-122.35
	Chiles Creek Trib	Linda Vista	Earth	38.558	-122.357
	Conn Creek	Conn Creek	Earth	38.482	-122.372
	Conn Creek Trib	La Herradura	Earth	38.518	-122.417
	Crystal Creek Trib	Crystal	Earth	38.535	-122.44
	Gordon Val Creek Trib	Morgan	Earth	38.337	-122.097
	Huichica Creek Trib	Hudson Vineyards	Earth	38.269	-122.367
	Kimball Creek	Kimball Creek	Earth	38.622	-122.61
	Ledgewood Creek	Olson	Earth	38.32	-122.087
	Maxwell Creek	Catacoula	Earth	38.562	-122.378
	Moore Creek	Angwin	Earth	38.582	-122.432
	Napa River Trib	St Helena Lower	Earth	38.507	-122.49
	Napa River Trib	Veterans Home	Earth	38.392	-122.377
	Napa River Trib	Old Waterworks	Gravity	38.32	-122.268
	Putah Creek	Monticello	Dam	38.513	-122.103
	Rector Creek	Rector Creek	Earth	38.442	-122.345
	Suisun Creek	Lake Curry Dam	Earth	38.358	-122.123
	York Creek	Diversion Dam On York Creek	Dam	38.5093	-122.4941
	York Creek	York Dam	Dam	38.5133517	-122.5013891
NEVADA	Deer Creek	Deer Creek Diversion	Variable Radius	39.268	-120.952
	Deer Creek	Scotts Flat	Earth	39.273	-120.928
	Deer Creek Trib	Anthony House	Earth & Rock	39.235	-121.22
	Dry Creek	Swan	Earth	39.135	-121.133
PLACER	Bear Creek	Kokila	Earth	38.762	-121.173
	Bear River Trib	Patterson Section 29	Earth	39.03	-121.335
	Bear River Trib	Auburn Valley # 3	Earth	39.002	-121.145
	Dry Creek	Pipeline Crossing	Pipeline	38.734	-121.274
	Dry Creek	Lakewood	Earth	38.962	-121.072
	Dry Creek	Watt Avenue Dam	Debris Dam	38.734	-121.391
	Dry Creek, South Fork	Christian Valley	Earth & Rock	38.922	-121.043
	Dry Creek, South Fork	Lake Arthur Dam	Earth	38.963	-121.023
	Dry Creek, South Fork	Lake Theodore	Earth	38.973	-121.012
	Dry Creek Trib	Halsey Forebay	Earth	38.973	-121.038
	Miners Ravine	Carolinda Dr.	Road	38.7537	-121.1799
	Miners Ravine	Itchy Acres	Road	38.7509	-121.1709
	Miners Ravine	Moss Lane	Road	38.7889	-121.1446
	Miners Ravine	Shadow Oak Bridge	Bridge	38.7850	-121.1799
	Miners Ravine	Leidinger	Road	38.7532513	-121.1708778
	Miners Ravine	Cottonwood Dam	Dam	38.764	-121.157
	Miners Ravine	Box Culvert	Road	38.7563	-121.2243
	Miners Ravine	Concrete Dam	Dam	38.7584	-121.2065
	Miners Ravine	Concrete Dam 3'	Dam	38.7584	-121.2065
	Miners Ravine	Leibinger Lane Box Culverts	Road	38.7531	-121.1719
	Miners Ravine	Cottonwood Dam	Dam	38.7641	-121.1592
	Miners Ravine	Flashboard Dam/Concrete apron	Dam	38.7838	-121.1495
	Miners Ravine	Flashboard Dam	Dam	38.7883	-121.1492
	Miners Ravine	Flashboard Dam 1.5'	Dam	38.7982	-121.1354
	Miners Ravine	Flashboard Dam 4'	Dam	38.8119	-121.1252
	Miners Ravine	Flashboard Dam 3'	Dam	38.8171	-121.1254
	Miners Ravine	Flashboard Dam 4'	Dam	38.8175	-121.1257
	Miners Ravine	Flashboard Dam/Concrete apron	Dam	38.8236	-121.126
	Miners Ravine	Culvert/Meal apron	Road	38.8252	-121.1259
	Secret Ravine	Triple Pipeline Crossing	Pipeline	38.7594	-121.2552
SACRAMENTO	American River	Nimbus	Gravity	38.637	-121.223
	American River Trib	Willow Hill	Earth	38.645	-121.153
	Cosumnes River	Latrobe Falls	Natural	38.521	-120.962
	Cosumnes River	Consumnes River Road Crossing	Road	38.3084636	-121.3765480
	Cosumnes River	Hopland Ranch Dam	Diversion	38.4051032	-121.2835950
	Cosumnes River	Blodgett Dam	Diversion	38.4511369	-121.2098876
	Cosumnes River	Granlees	Gravity	38.497	-121.065

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COUNTY	River Name	Barrier Name	Description	Latitude	Longitude
	Cosumnes River Trib	Clementia	Earth	38.502	-121.067
	Cosumnes River Trib	Chesbro	Earth	38.51	-121.072
	Cosumnes River Trib	Mills	Earth	38.5	-121.107
	Cosumnes River	Summer Dam #1	Dam	38.452	-121.209
	Cosumnes River	Summer Dam #4	Dam	38.371	-121.323
	Dry Creek	Hayer Dam	Dam	38.683	-121.442
	Dry Creek Trib	Hamel	Earth	38.305	-121.057
	Laguna Creek Trib	Gall	Earth	38.302	-121.332
	Sacramento River	Sacramento Weir	Weir	38.6056	-121.5561
	Unnamed	Battery	Earth	38.442	-121.478
SAN JOAQUIN	Calaveras River	Clements Dam	Diversion	38.045	-121.077
	Calaveras River	Cherryland Dam	Diversion	38.008	-121.249
	Calaveras River	McGurk Earth Dam	Dam	38.065	-120.985
	Calaveras River	Bellota Weir	Diversion	38.052	-121.011
	Calaveras River	Solari Dam	Dam	38.020	-121.213
	Calaveras River	Pezzi Dam	Dam	38.046	-121.197
	Calaveras River	Williams Crossing	Dam	38.072	-120.923
	Calaveras River	Eight-Mile Dam	Dam	38.061	-121.161
	Calaveras River	Tully Dam	Dam	38.069	-121.123
	Calaveras River	Wilsons Crossing Dam	Dam	38.068	-120.974
	Calaveras River	Mcallen Dam	Dam	38.005	-121.268
	Calaveras River	Calaveras Head Works	Dam	38.053	-121.013
	Calaveras River	Murphy Dam	Dam	38.049	-121.191
	Calaveras River Trib	Davis No 2	Earth	38.057	-121.03
	Calaveras River Trib	Foothill Ranch	Earth	38.102	-121.03
	Mokelumne River	Woodbridge Dam	Irrigation Dam	38.157	-121.297
	Mokelumne River	Barrier Near Thornton	Diversion		
	Mokelumne River Trib	Beggs	Earth	38.217	-121.045
	Mormon Slough	Caprini Crossing	Dam	37.961	-121.159
	Mormon Slough	Motoide Dam	Dam	38.040	-121.046
	Mormon Slough	Fine Dam	Dam	38.03	-121.047
	Mormon Slough	Avansino Dam	Dam	38.020	-121.061
	Mormon Slough	Hogan Crossing	Dam	37.965	-121.138
	Mormon Slough	Watkins Crossing	Road	38.040	-121.029
	Mormon Slough	Main Street Dam	Dam	37.960	-121.199
	Mormon Slough	Mormon Slough Trestle	Road	37.979	-121.09
	Mormon Slough	Hosie Dam	Dam	38.008	-121.07
	Mormon Slough	Bonomo Dam	Dam	37.993	-121.082
	Mormon Slough	Piazza Dam	Dam	37.993	-121.09
	Mormon Slough	Prato Dam	Dam	37.978	-121.111
	Mormon Slough	Mcclean Dam	Dam	37.965	-121.136
	Mormon Slough	Lavaggi Dam	Dam	37.963	-121.155
	Mormon Slough	Panella Dam	Dam	37.961	-121.169
	Mormon Slough	Budiseli Dam	Dam	37.98	-121.246
	Mormon Slough	Fujinaka Crossing	Dam	37.968	-121.120
	Mormon Slough	Hosie Low Water Crossing	Road	38.006	-121.082
	Mormon Slough Trib	Gilmore	Earth	38.043	-120.99
	Mosher Creek	Webster Dam	Dam	38.049	-121.072
	Mosher Creek	Gurnsey Crossing	Road	38.052	-121.087
	Mosher Creek	Lyons Dam	Dam	38.074	-121.166
	Mosher Creek	Bear Creek Check & Spill S.J.F.C.	Dam	38.073	-121.202
	Mosher Creek	Diversion Dam/Mosher Creek	Dam	38.072	-121.198
	Mosher Creek	Cotta & Ferreira Concrete Crossing	Road	38.055	-121.223
	Mosher Creek	Cotta & Ferreira Dirt Crossing	Road	38.056	-121.219
	Mosher Creek	Cotta & Ferreira Dam	Dam	38.058	-121.214
	Mosher Creek	Cortopassi Dam #2	Dam	38.069	-121.203
	Mosher Creek	Cortopassi Dam #1	Dam	38.071	-121.203
	Mosher Creek	Leffler Dam	Dam	38.054	-121.243
	New Channel Of Potter Creek	Cliff Motoike Sack Dam	Dam	37.994	-121.070
	New Channel Of Potter Creek	Billingsmeier Dam	Dam	38.014	-121.054
	New Channel Of Potter Creek	Leonardini Dirt Crossing	Road	38.012	-121.060
	Potter Creek	McCarthy Crossing	Dam	37.9947	-121.0650
	Potter Creek	Sanguinetti Dam	Dam	37.9664	-121.0856
	Potter Creek	Machado Crossing	Road	37.9861	-121.0728
	Potter Creek	Sam Motoike	Road	38.0358	-121.0317
	Potter Creek	Kennedy Dam	Dam	38.016	-121.042
	Potter Creek	Billingsmeier Rock Dam	Dam	38.0098	-121.0664
	Potter Creek	Gonser Crossing	Dam	37.9647	-121.1028
	Potter Creek	Cavagnaro Crossing	Dam	37.9608	-121.1033
	Potter Creek	Stagnaro Crossing	Dam	37.9608	-121.1117
	Potter Creek	Delucci Crossing	Dam	37.9572	-121.1475
	Potter Creek	Delucci #2 Crossing	Dam	37.9572	-121.1403
	Potter Creek	Fowler Bridge	Dam	38.0275	-121.0419
SAN MATEO	San Joaquin River Trib	Reg WW CNT OXID	Earth Dam	37.933	-121.342
	Bear Gulch	Weir	Weir	37.4155	-122.2420

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Appendix A. Known Structures Within CALFED ERP Geographic Scope

COUNTY	River Name	Barrier Name	Description	Latitude	Longitude
	Bear Gulch	Pipe	Pipeline	37.4216	-122.2465
	Bear Gulch	Weir	Weir	37.4169	-122.2435
	Bear Gulch	Dam	Dam	37.414	-122.2417
	Bear Gulch	Dam	Dam	37.412	-122.240
	Bear Gulch	Highway 84 Crossing	Culvert	37.4176	-122.2664
	Bear Gulch	Weir	Weir	37.4236	-122.2400
	Bear Gulch	Fox Hollow Bridge	Culvert	27.4256	-122.2617
	Bear Gulch	California Water Service Dam	Dam	37.4159	-122.2684
	Belmont Creek	Notre Dame	Earth	37.508	-122.307
	Laurel Creek	Laurel Creek	Earth	37.527	-122.322
	Mcgarvy Gulch	Bridge Apron	Culvert	37.4440	-122.2938
	Peters Creek	Rickey	Earth	37.307	-122.173
	San Francisquito Creek	Searsville Dam	Dam	37.4073978	-122.2369044
	Sanchez Creek	Crocker	Earth	37.565	-122.373
	Squealer Gulch	Greer Road Crossing	Road	37.4368	-122.2828
	West Union Creek	Weir	Weir	37.4336	-122.2776
	West Union Creek	Weir	Weir	37.4372	-122.2827
	West Union Creek	Fence	Fence	37.4276	-122.2692
	West Union Creek	Dam	Dam	37.4314	-122.2752
	West Union Creek	Highway 84 Crossing	Culvert	37.4253	-122.2660
SANTA CLARA	Alamitos Creek Trib	Almaden Valley	Earth	37.198	-121.84
	Almitos Creek	Almaden	Earth	37.165	-121.828
	Arroyo De Los Coches Trib	Ed R. Levin	Earth	37.455	-121.86
	Beardsley Creek	Lake Ranch	Earth	37.22	-122.052
	Coyote Creek	Coyote Percol	Flashboard & Buttress	37.24	-121.763
	Coyote Creek	Leroy Anderson	Earth	37.167	-121.628
	Guadalupe Creek	Guadalupe	Earth	37.198	-121.878
	Los Gatos Creek	Vasona Percolation	Earth	37.247	-121.963
	Los Gatos Creek	Lexington	Earth	37.202	-121.988
	Los Gatos Creek	Austrian	Earth	37.132	-121.93
	Los Trancos Creek	Agosti dam	Dam	37.3761	-122.1963
	Los Trancos Creek	Pierce Lane Concrete Weir	Weir		
	Los Trancos Creek	Webb Ranch Concrete Weir	Concrete Weir		
	Los Trancos Creek	Highway 280 Concrete Curbs (3)	Concrete curb		
	Los Trancos Creek	Felt Lake diversion dam	Diversion dam		
	Los Trancos Creek	Emergency Road 2X box culvert	culvert	37.361	-122.201
	Los Trancos Creek	Old Flashboard Dam	Flashboard Dam		
	Los Trancos Creek	L.T. Road double box culvert	culvert	37.375	-122.199
	Los Gatos Creek	Williams	Gravity	37.122	-121.907
	San Francisquito Creek	Waverly St. Concrete weirs (3)	Concrete weirs		
	San Francisquito Creek	Bond Bridge apron	apron		
	San Francisquito Creek	Lake Lagunita diversion dam	Diversion dam		
	San Francisquito Creek	Jasper Ridge BP fire road crossing	Road crossing		
	San Francisquito Creek	Searsville Dam	Dam		
	San Francisquito Creek	Concrete Drop Structure	Drop Structure	37.4543	-122.1596
	San Francisquito Creek	Clark Avenue Concrete Rubble And Slurry Dam	Dam	37.4534	-122.1303
	San Francisquito Creek	Stanford Golf Cart Crossing	Road	37.4238	-122.189359
	San Francisquito Creek	El Palo Alto Drop Structure	Drop Structure	37.4541	-122.1599
	San Francisquito Creek	USGS Gauging Station Dam	Dam	37.4192	-122.1875
	Stevens Creek	Stevens Creek	Earth	37.298	-122.077
SHASTA	Clear Creek	ACID Siphon	Dam	40.5067	-122.3883
	Clear Creek	Saeltzer Dam	Diversion	40.493	-122.470
	Clear Creek	Whiskeytown Dam	Dam	40.598	-122.537
	Cow Creek	Cow HydroelectricDam	Hydro Diversion		
	Cow Creek	Irrigation Diversion Dams	Diversion		
	Little Cow Creek	Diversion	Irrigation Diversion	40.641	-122.212
	Little Cow Creek	McMillan Hydro	Hydro Diversion	40.773	-121.831
	North Fork Battle Creek	North Battle Creek Feeder Diversion	Hydro Diversion	40.452	-121.861
	Old Cow Creek	Kilarc Hydro Dam	Hydro Diversion	40.687	-121.807
	Old Cow Creek	Old Cow Dam	Dam	40.616	-122.004
	Old Cow Creek	Olsen Hydroelectric Project	Hydro Diversion	40.664	-121.896
	Sacramento River	Anderson Cottonwood	Flashboard & Buttress	40.593	-122.393
	Sacramento River	Keswick	Gravity	40.612	-122.445
	Sacramento River	Keswick	Gravity	40.612	-122.443
	South Cow Creek	Poulton Hydro Diversion	Irrigation Diversion	40.567	-122.027
	South Cow Creek	South Cow	Hydro Diversion	40.593	-121.981
	South Cow Creek	South Cow Diversion	Dam	40.588	-121.944
SOLANO	Carquinez Straight Trib	Swanzy Lake	Earth	38.077	-122.225
	Napa River Trib	Lake Chabot	Earth	38.14	-122.238
	Pennsylvania Cr	Pennsylvania Cr	Earth	38.26	-122.063
	Putah Creek	Agricultural Road On Putah Creek	Culvert	38.5167529	-121.6376414
	Putah Creek	Putah Diversion Dam	Dam	38.494	-122.004
	Putah Creek	Bypass Check Dam	Dam	38.5157714	-121.6107916
	Putah Creek	Winters Percolation Dam	Dam	38.5216491	-121.9638524
	Suisun Bay Trib	Pond 2b	Earth	38.102	-122.125

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Appendix A. Known Structures Within CALFED ERP Geographic Scope

COUNTY	River Name	Barrier Name	Description	Latitude	Longitude
SONOMA	Suisun Creek Trib	Municipal	Earth	38.298	-122.143
	Sulphur Springs Creek	Lake Herman	Earth	38.097	-122.15
	Ulatis Creek	Unknown	Dam	38.3289	-121.8126
	Ulatis Creek	Maine Prairie 3	Flashboard & Buttress	38.335	-121.815
	Unnamed	Summit Reservoir	Earth	38.153	-122.225
	Carriger Creek Trib	Lowrey No 1	Earth	38.323	-122.563
	Hudeman Slough Trib	Buena Vista Winery	Earth	38.232	-122.357
	North Creek	Lawler	Earth	38.297	-122.577
	Petaluma Creek Trib	Sleepy Hollow 2	Earth	38.158	-122.493
	Petaluma River Trib	Pinheiro	Earth	38.237	-122.532
STANISLAUS	Sonoma Creek	Suttenfield	Earth	38.355	-122.512
	Tolay Creek Trib	Sonoma Hills	Earth	38.214	-122.507
	Dry Creek 2 Trib	Gatzman Creek Dam	Dam	37.732	-120.545
	Lesnini Creek	Rodden Lake Dam	Earth Dam	37.818	-120.763
	San Joaquin River	Hills Ferry	Fish Screen	37.349	-120.974
	Stanislaus River	Gravel Pit 1	Pits	37.753	-121.014
	Stanislaus River	Gravel Pit 2	Pits	37.764	-120.913
	Stanislaus River	Gravel Pit 3	Pits	37.769	-120.895
	Stanislaus River	Gravel Pit 4	Pits	37.769	-120.897
	Stanislaus River	Gravel Pit 5	Pits	37.771	-120.892
	Stanislaus River	Gravel Pit 6	Pits	37.788	-120.741
	Stanislaus River	Gravel Pit 7	Pits	37.814	-120.704
	Stanislaus River	Gravel Pit 8	Pits	37.809	-120.686
	Stanislaus River	Gravel Pit 9	Pits	37.811	-120.741
	Stanislaus River	Gravel Pit 10	Pits	37.819	-120.663
	Stanislaus River	Gravel Pit 11	Pits	37.802	-120.666
	Stanislaus River	Gravel Pit 12	Pits	37.822	-120.656
	Stanislaus River	Oakdale Recreation Area 1	Pits	37.771	-120.884
	Stanislaus River	Oakdale Recreation Area 2	Pits	37.770	-120.879
	Stanislaus River	Oakdale Recreation Area 3	Pits	37.771	-120.874
	Stanislaus River	Oakdale Recreation Area 4	Pits	37.771	-120.869
	Stanislaus River	Oakdale Recreation Area 5	Pits	37.772	-120.867
	Stanislaus River	Ohe Gravel Quarry	Pits	37.808	-120.675
	Stanislaus River	Orange Blossom Bridge	Bridge	37.783	-120.750
STANISLAUS	Stanislaus River	Willms	Pits	37.813	-120.700
	Tuolumne River	Basso Bridge	Bridge	37.645	-120.495
	Tuolumne River	Basso Bridge Run / Pool	Pits	37.646	-120.494
	Tuolumne River	Clark's Pool	Pits	37.641	-120.664
	Tuolumne River	Dennett Dam	Dam	37.627	-120.986
	Tuolumne River	Fox Grove 1	Pits	37.618	-120.847
	Tuolumne River	Fox Grove 2	Pits	37.620	-120.843
	Tuolumne River	Geer Road Bridge	Bridge	37.618	-120.844
	Tuolumne River	Gravel Pit 1	Pits	37.644	-120.676
	Tuolumne River	La Grange	Gravity	37.672	-120.443
	Tuolumne River	M.J. Ruddy Conveyor Bridge	Bridge	37.633	-120.783
	Tuolumne River	New La Grange Bridge	Bridge	37.667	-120.470
	Tuolumne River	Old La Grange Bridge	Bridge	37.666	-120.461
	Tuolumne River	Railroad Trestle	Bridge	37.626	-120.992
	Tuolumne River	Special Run Pool 2	Pits	37.627	-120.526
	Tuolumne River	Special Run Pool 3	Pits	37.630	-120.552
	Tuolumne River	Special Run Pool 4	Pits	37.635	-120.594
	Tuolumne River	Special Run Pool 5	Pits	37.638	-120.727
	Tuolumne River	Special Run Pool 6	Pits	37.626	-120.780
	Tuolumne River	Special Run Pool 7	Pits	37.615	-120.798
	Tuolumne River	Special Run Pool 8	Pits	37.619	-120.824
	Tuolumne River	Special Run Pool 9	Pits	37.620	-120.843
	Tuolumne River	Special Run Pool 10	Pits	37.616	-120.856
	Tuolumne River Trib	Dawson Lake	Earth Dam	37.64	-120.477
	Tuolumne River Trib	Modesto Reservoir Dam	Dam	37.657	-120.45
	Tuolumne River Trib	Turlock Lake	Hydraulic Fill	37.612	-120.593
SUTTER	Butte Creek	Colusa Shooting Weir	Weir	39.234	-121.937
	Butte Creek	Drivers Cut Weir	Weir	39.259	-121.940
	Butte Creek	Sanborn Slough Bifurcation Structure	Dam	39.359	-121.894
	Butte Creek	Tisdale Weir	Weir	39.025	-121.819
	Cherokee Canal	Field And Tule Weir	Weir	39.289	-121.906
	Cherokee Canal	Mile Long Canal	Weir	39.289	-121.905
	Cherokee Canal	Morton Weir	Weir	39.289	-121.906
	Sutter Bypass/East Canal	Nelson Slough Weir	Weir	38.896	-121.617
	Sutter Bypass/East Canal	Sutter Bypass Weir #2	Weir	39.103	-121.758
	Sutter Bypass/East Canal	Willow Slough	Weir	38.915	-121.623
	Sutter Bypass/West Canal	East-West Diversion Weir	Diversion	39.146	-121.841
	Sutter Bypass/West Canal	Guisti Weir	Weir	39.07	-121.758
	Sutter Bypass/West Canal	Sutter Bypass Weir #1	Weir	39.035	-121.743
	Sutter Bypass/West Canal	Sutter Bypass Weir #3	Weir	39.035	-121.743

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Appendix A. Known Structures Within CALFED ERP Geographic Scope

COUNTY	River Name	Barrier Name	Description	Latitude	Longitude
	Sutter Bypass/West Canal	Sutter Bypass Weir #5	Weir	39.136	-121.831
TEHAMA	Antelope Creek	Edwards Ranch Diversion	Diversion	40.187	-122.134
	Antelope Creek	Los Molinos Irrigation District Dam	Diversion	40.187	-122.134
	Antelope Creek	Los Molinos Water Company Diversion	Diversion	40.187	-122.134
	Battle Creek	Coleman Diversion Dam	Weir	40.398	-122.144
	Deer Creek	Canyon Mouth	Diversion	40.011	-121.953
	Deer Creek	Cone-Kimball Diversion Dam	Diversion	39.969	-122.016
	Deer Creek	Lower Falls	Natural	40.168	-121.580
	Deer Creek	Stanford-Vina Dam	Dam	39.963	-122.033
	Deer Creek	Upper Falls	Natural	40.202	-121.512
	Elder Creek	Corning Canal Siphon	Unknown	40.044	-122.217
	Elder Creek	Seasonal Gravel Dam	Unknown	40.017	-122.382
	Mill Creek	Clough Dam	Diversion	40.056	-122.040
	Mill Creek	Upper Diversion Dam	Diversion	40.055	-122.031
	Mill Creek	Ward Dam	Diversion	40.053	-122.077
	North Fork Battle Creek	Eagle Canyon Dam	Hydro Diversion	40.424	-121.918
	North Fork Battle Creek	Wildcat Dam	Hydro Diversion	40.420	-121.960
	Paynes Creek	Diversion	Diversion	40.264	-122.186
	Sacramento River	Red Bluff Diversion Dam	Dam	40.153	-122.201
	South Fork Battle Creek	Boulders At Panther Creek	Natural	40.357	-121.727
	South Fork Battle Creek	Coleman Diversion Dam	Hydro Diversion	40.402	-121.967
TEHAMA	South Fork Battle Creek	Inskip Diversion Dam	Hydro Diversion	40.395	-121.882
	South Fork Battle Creek	Lower Ripley Creek Diversion Dam	Diversion	40.400	-121.921
	South Fork Battle Creek	Soap Creek Diversion Dam	Diversion	40.385	-121.819
	South Fork Battle Creek	South Diversion Dam	Hydro Diversion	40.369	-121.797
	Stony Creek	Black Butte	Earth	39.818	-122.337
	Stony Creek	Black Butte Reregulation	Hydro Diversion	39.808	-122.330
	Thomes Creek	Gravel Mines	Pits, Stranding	39.977	-122.203
	Thomes Creek	Henleyville Diversion Dam	Diversion	39.957	-122.327
	Thomes Creek	Paskenta Diversion Dam	Diversion	39.890	-122.517
TUOLUMNE	Dry Creek Trib 1	Mid Cooperstown Dam	Dam	37.75	-120.537
	Dry Creek Trib 2	Kilmer Dam	Dam	37.762	-120.6
	Tuolumne River	New Don Pedro	Earth & Rock Dam	37.701	-120.420
YOLO	Cache Creek	Cache Cr Settling Basin	Earth	38.683	-121.673
	Sacramento River	Fremont Weir	Flood Control Dam	38.7811665	-121.6163725
YUBA	Bear River	Camp Far West	Earth & Rock	39.05	-121.315
	Bear River	Camp Far West Diversion	Gravity	39.042	-121.332
	Yuba River	Daquerre Point Dam	Dam	39.209	-121.444
	Yuba River	Englebright	Variable Radius	39.239	-121.269

Appendix B: Applicable Laws and Examples of Fish Passage Programs at Other Agencies

Applicable Laws and Regulations

Fish and Game Commission, Department of Fish and Game

The Fish and Game Commission and the Department of Fish and Game are the fish and wildlife resource management branch of state government. DFG has broad jurisdiction over man-made or natural fish barriers, fishways, dam modifications, fish water bypasses, artificial barriers, and fish entrainment situations.

In the early 1900s, the California Legislature made it unlawful to impede fish passage (Fish and Game Code Sections 5901 and 5931 et seq.) and made unlawful the accumulation of mining debris or logjams that impede fish passage (Fish and Game Code Section 5948). Later it required fish screens on diversions (Fish and Game Code Section 5980).

DFG has mandates that give it authority to influence the management of watersheds through inspecting the design of dams for fishery protection, issuing Streambed Alteration Agreements, and commenting on Timber Harvest Plans. DFG is mandated "from time to time" to examine all dams in the state and to order, upon a finding by the Fish and Game Commission, dam owners to construct a fishway if there is not free passage for fish over or around the dam (Fish and Game Code Section 5930-1). FGC Section 5937 requires dam owners to allow sufficient water to pass through the dam to keep in good condition any fisheries below the dam.

The Fish and Game Commission receives applications for new dams filed with the Department of Water Resources and can order the construction of a fishway if it is necessary and practical. If not, the Commission can order the owner to establish a fish hatchery (Fish and Game Code Sections 5933 and 5938). Of broad effect, Fish and Game Code Section 1600 et seq. charges the DFG with regulating any project altering the bed, bank or channel of a river, stream, or lake if that project may substantially impact fish and wildlife resources.

In issuing a Streambed Alteration Agreement, DFG is required to propose modifications to the project to protect any fish and wildlife resources on the site that may be substantially adversely affected. The Salmon, Steelhead Trout and Anadromous Fisheries Program Act of 1988 required DFG to establish a comprehensive program to increase the natural production of Salmon and Steelhead Trout, as opposed to hatcheries. The act established as state policy that this should be accomplished primarily through improvement in stream habitat. In addition, habitats shall not be diminished without offsetting the impacts (Fish and Game Code Section 6900 et seq.). DFG reviewed dam removals in the Klamath River Drainage in the early 1950s. Subsequently, in the early 1950s, 23 dams were removed opening up at least 210 miles of spawning stream (Handley and Coots 1953).

State and Federal Species Protection Legislation

In 1970, California enacted the Endangered Species Act. Three years later, the federal Endangered Species Act of 1973 became law. Both laws protect animal species by designating them as either threatened or endangered. The laws require state and federal agencies to develop and implement plans to protect and recover populations of the designated species. The U.S. Fish and Wildlife Service and the National Marine and Fisheries Service enforce the federal version of the law, and the DFG is responsible for enforcement of the state law.

In October 1986, the federal Electric Consumer Protection Act was enacted. It required the Federal Energy Regulatory Commission consider the value of fish and wildlife in its hydroelectric power program. It also required recommendations of federal and state fish and wildlife agencies be considered when new power plants are built. In 1992, the federal Central

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Appendix B: Applicable Laws and Examples of Fish Passage Improvement Programs

Valley Project Improvement Act became law. It required that the Central Valley Project consider fish and wildlife protection and restoration as important a priority as irrigation, domestic water uses, and power generation.

Other Programs

California Resources Agency

In November 1999, the California Resources Agency convened a group of interested State, local and federal agencies, fisheries conservation groups, researchers, restoration contractors, and others to discuss ways to restore and recover anadromous salmonid populations by improving fish passage at road crossings with culverts. This effort was part of the Resources Agency's effort to implement the California Coastal Salmon and Watersheds Program, which included an objective to coordinate fish passage activities. Through coordinating resources and authorities and creating the Fish Passage Forum, a comprehensive program was achieved and will be formalized in a Memorandum of Understanding to be signed by all cooperators by the end of 2002. The DFG, as trustee for fisheries resources, serves as the principal coordinator for the Fish Passage Forum.

The Fish Passage Forum participants have worked together to develop short-term solutions for several high priority fish passage projects. They have also developed a strategic plan to facilitate and coordinate fish passage inventory and assessment, data sharing and database development needs, fish passage design, fish passage project implementation, training, and public education and outreach. For more information, contact: Cathy Bleier, Resources Agency, (916) 653-6598, E-mail: cathy@resources.ca.gov, or Julie Brown, DFG, (916) 327-8843, E-mail: jbrown@dfg.ca.gov.

Five-counties Program

The five north coast counties of Humboldt, Mendocino, Trinity, Siskiyou, and Del Norte began a coordinated effort to inventory, prioritize, and resolve fish passage at road crossings, such as bridges, roads, and culverts. It is being overseen by the National Marine Fisheries Service and is going into its fourth year. For more information, contact: Miles Croom, (707) 575-6068, E-mail: Miles.Croom@noaa.gov

California Department of Fish and Game

DFG carries out many fish passage and fish protection projects through a variety of programs. DFG's fish passage programs are implemented by the regional offices. Two fish screen shops in Region 1, one shop in Region 2, and one shop in Region 4 build, install, and maintain screens for diversions and some fish ladders. Central Valley region offices (Regions 1, 2 and 4) each have an Anadromous Fish Restoration Program Coordinator supported by the USFWS AFRP which coordinates with local, federal and other state agencies on fish passage and fish protection, and habitat restoration projects in the region. In addition, DFG provides funds from grant and bond programs for projects that benefit anadromous salmonids, including fish passage projects. Proposals are accepted annually and advisory committees recommend projects for funding. These funding programs and their guidelines are discussed in more detail in Chapter 6.

DFG established a Statewide Fish Passage Coordinator in the Native Anadromous Fish and Watershed Branch, assisting in the coordination of fish passage programs in other agencies and non-governmental organizations, as well as acting as lead person coordinating the Fish Passage Forum for statewide activities to restore anadromous fish passage.

DFG's Statewide Fish Screen and Fish Passage Program, part of the Inland Fisheries Division's Salmon, Steelhead Trout and Anadromous Fisheries Restoration and Enhancement Program, has identified, and are currently performing the following activities: 1) inventory of water diversion and fish passage problems; 2) evaluation and prioritization of fish screening and fish passage problems; 3) implementation or coordination fish protection activities; 4) evaluation of existing and proposed fish protective installations; and 5) review of

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Appendix B: Applicable Laws and Examples of Fish Passage Improvement Programs

fish screening and fish passage literature. For more information, contact: Paul Raquel, (916) 227-2330, E-mail: praquel@dfg.ca.gov.

Fish Passage Criteria

DFG has developed draft guidelines that address fish passage at road crossings and culverts. The guidelines set criteria for water velocities, water depths and high and low passage flows for adult and juvenile salmonids. The draft guidelines are available from DFG upon request. FPIP uses these and NMFS criteria to guide evaluations of road crossings and culverts.

California Coastal Conservancy

The State Coastal Conservancy provides grants and technical assistance to nonprofits, local governments, Resource Conservation Districts, and other organizations for watershed planning, assessment, implementation projects, and monitoring. Many such efforts address fish migration barriers. The Conservancy is currently participating with State and federal agencies and nonprofit organizations in evaluating the removal of Matilija Dam, evaluating alternatives for fish passage at San Clemente Dam on the Carmel River, contributing funding for fish ladders on Robles Dam on the Ventura River, and providing funding for fish passage improvement projects in Humboldt, Del Norte, and Mendocino counties. Through an interagency agreement, FPIP is assisting the California Coastal Conservancy with its coastal barrier inventory. The Conservancy, with \$750,000 provided by state legislation, is developing a comprehensive assessment of barriers to fish passage in many coastal watersheds. The assessment will compile and standardize existing data into an Internet accessible GIS database. The assessment program will be augmented by an ongoing Conservancy funded assessment of road and stream crossings in Marin County, and proposed assessments of barriers in streams of the Santa Monica Mountains, and the Sisquoc watershed. In compiling this assessment, the Conservancy will draw from many other barrier assessment efforts statewide. A final report of the program is due in Feb 2003. For more information, contact: Michael Bowen, (510) 286-0720, E-mail: mbowen@scc.ca.gov.

California Department of Transportation

In 2000, Caltrans began implementing a Statewide Passage Barrier Assessment and Correction Program within each of its districts to assess state highway culverts and stream crossings for fish passage impediments. The program will enhance Caltrans overall rate of completing inventories and to facilitate prioritization of funding for sites needing correction.

The statewide assessment of highway culverts started along the Northern California coast (District 1) and is now progressing to the northeast and Central Coast areas of the state (Districts 2, 4, 5). Humboldt State University, as part of an interagency agreement with Caltrans, is performing the field assessment and analysis of state highway routes in Northern California.

CalTrans and DWR FPIP signed an Interagency Agreement to assist with inventory and analysis of culverts along the remainder of the state's highways. Caltrans is pursuing restoration partnerships with other agencies and local watershed groups as one method of augmenting funding for implementing corrective actions at road crossings to improve fish passage conditions.

In 2001, Caltrans and the National Park Service received an Environmental Enhancement and Mitigation grant for fish passage remediation on Solstice Creek. The Caltrans program is also working on development of a fish passage engineering manual for Caltrans engineers and biologists to use as a guide for road and culvert construction in streams. For more information on Caltrans efforts to restore fish passage, contact: Deborah McKee, (916) 653-8566, E-mail: Deborah_McKee@dot.ca.gov.

Bulletin 250: Fish Passage Improvement

Appendix B: Applicable Laws and Examples of Fish Passage Improvement Programs

National Marine Fisheries Service

FERC relicensing

NMFS has authority under Sections 18 and 10(j) of the Federal Power Act to protect fish at hydroelectric facilities. Specifically, under section 10(j) NMFS recommends to a FERC licensee conditions for fish protection, mitigation, and enhancement. Section 18 expressly authorizes the Department of Commerce to issue mandatory fishway prescriptions, stating that FERC must require construction, maintenance, and operations by a licensee at its own expense of such fishways as may be prescribed by the Secretary. Over the next 10 or more years, NMFS proposes to participate in numerous FERC relicensing actions. Forty-two project licenses in California are either undergoing relicensing or will expire between 2000 and 2010. The FERC anticipates that up to 85 percent of project applicants will opt to use the Alternative Licensing Process, a new collaborative approach to relicensing intended to improve efficiency. NMFS anticipates greatly increased demands on staff as a result. For more information contact Steve Edmondson, (707) 575-6080, E-mail: steve.edmondson@noaa.gov.

Fish Passage Criteria

NMFS has developed criteria for water velocities, water depths and high and low passage flows for adult and juvenile salmonids. The NMFS guidelines are available at www.swr.nmfs.noaa.gov. The guidelines address fish passage at road crossings and culverts. FPIP uses these and DFG criteria to guide evaluations of road crossings and culverts.

United States Bureau of Reclamation

CVPIA Anadromous Fish Restoration and Screening Programs

USBR is involved with fish passage improvements in the Central Valley through two CVPIA funded programs, the Anadromous Fish Screen Program (AFSP) and the Anadromous Fish Restoration Program (AFRP). The Anadromous Fish Screen Program directs the Department of the Interior to help the state avoid losses of juvenile anadromous fish resulting from unscreened or inadequately screened diversions. The program provides a mechanism and a major source of funds to minimize and avoid loss of juvenile anadromous fish at diversions. Since 1996, the AFSP has helped fund over 25 projects, 17 of which have been completed. Through the program, nearly 4,000 cfs of diversions will be screened, and roughly 70 percent of all diversions over 250 cfs will be screened within the Sacramento and San Joaquin River systems, the Delta, and Suisun Marsh by end of 2002 fiscal year. For more information, contact: Bill O'Leary, USBR AFSP, (916) 978-5207, E-mail: woleary@mp.usbr.gov.

The Anadromous Fish Restoration Program implements a program through a variety of actions that has the goal of at least doubling natural production of anadromous fish in California's Central Valley streams. Since 1995, the AFRP has helped implement more than 70 projects to restore natural production of anadromous fish. The USBR and USFWS jointly manage and fund projects such as the removal of Saeltzer Dam on Clear Creek (see Chapter 3), and improvements at Red Bluff Diversion Dam on the Sacramento River (see Chapter 5). In addition, USBR responded to a request from Ventura County for assistance with investigations at Matilija Dam on Matilija Creek. USBR was already performing fish passage and flood control projects at two other dams in the same watershed, so it was deemed appropriate for the agency to undertake sediment and feasibility studies at Matilija Dam, as well (see Chapter 3). For more information, contact: John Icanberry, USFWS AFRP, (209) 946-6400, E-mail: john_icanberry@fws.gov.

Bulletin 250: Fish Passage Improvement

Appendix B: Applicable Laws and Examples of Fish Passage Improvement Programs

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Appendix C: Structure Removal Examples and Challenges

Red Bluff Diversion Dam Fish Passage Improvement – Tehama County

Red Bluff Diversion Dam is on the Sacramento River immediately downstream of Red Bluff. When the dam's gates are lowered into the Sacramento River, the water behind the 41-foot-high and 752-foot-wide dam is raised, creating Lake Red Bluff and allowing gravity diversion into the Tehama-Colusa and Corning Canals for delivery to 17 irrigation districts. With the gates in place, the dam presents an upstream and downstream obstacle to



Red Bluff Diversion Dam

migrating fish. Fish ladders are inefficient at certain flows. Additionally, the tailrace and lake created by the dam provide habitat for species that prey on juvenile salmon, reducing their survival rates. Fish passage at the dam is crucial because a substantial number of Chinook salmon in the Sacramento River naturally spawn in the reach upstream of the dam.

In 1995, a large research pumping plant was installed. The pumps take fish and water at the same time, but screen the fish out after pumping. Testing of the pumps concluded in 2001, and results are being reviewed to determine if such technology could be used in place of the diversion dam or elsewhere. Capital and research costs were about \$25 million.

In addition, the Tehama-Colusa Canal Authority — with Central Valley Project Improvement Act and California Proposition 204 funds — and the U.S. Bureau of Reclamation are jointly funding the Fish Passage Improvement Project at the dam. The project is seeking alternative diversions to reduce the impacts of the dam on upstream and downstream migration of juvenile and adult anadromous fish, while improving the reliability of agricultural water supply to the Tehama-Colusa and Corning Canal systems. Three alternatives include 1) dam improvements and construction of new fish ladders, 2) fish screens and pumps, or 3) year-round “gates-out” with water diverted by pumps and screened intakes. Recreation at the lake is important to Red Bluff and the surrounding community, so alternatives that affect the lake must be carefully weighed.

The project is in Phase II, Preliminary Design and Environmental Documentation. A record of decision (ROD) is expected by April 2003. Once the ROD is completed future phases will include Phase III, Final Design and Permit Coordination, Phase IV, Construction, and Phase V, Monitoring, which will be conducted for 7-10 years thereafter.

Cooperating agencies, organizations, and others include TCCA, USBR, city of Red Bluff, Tehama County, Red Bluff Chamber of Commerce, Farm Bureau, fishing and environmental interests, educational groups, USFWS, NMFS, DFG, and DWR. For more information, contact:

- Website: <http://www.tccafishpassage.org/>
- Mike Urkov, Project Planner, CH2M Hill, (530) 229-3238.
E-mail: murkov@ch2m.com, or

- Harry Rectenwald, DFG. (530) 225-2368. E-mail: hrectenw.@dfg.ca.gov
- Art Bullock, TCCA, (530) 934-2125. E-mail: tcwaterman@aol.com, or
- Max Stodolski, USBR, (530) 529-3890. E-mail: mstodolski@mp.usbr.gov.

Diversion Dams, Butte Creek – Butte County

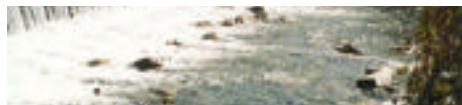
Numerous restoration projects on Butte Creek are completed or are under way. The creek is one of four Sacramento River tributaries that support populations of Central Valley spring-run Chinook salmon. The Western Canal Water District's Butte Creek Fish Passage Improvement Project involved five dams: Point Four Dam, Western Canal Main Dam, Western Canal East Channel Dam, McGowan Dam, and McPherrin Dam. The dams ranged from 6 to 12 feet high and 10 to 100 feet wide.

The project objectives were to eliminate 12 unscreened diversions that impacted juvenile salmonids, reconfigure water delivery facilities to make them fish-safe, restore spawning and rearing habitat for threatened spring-run Chinook salmon, and increase water supply reliability for agriculture and in wildlife refuges. The project also faced the challenges of working within the allowable construction windows to avoid or minimize impacts to salmonids, avoiding interruption of water deliveries during construction, determining how to dewater the construction sites, and overcoming logistical difficulties associated with the distance between construction sites. The project covered 60 square miles.

Completed in the early 1900s, the Western Canal Main and Western Canal East Channel Dams allowed WCWD's Main Canal to cross Butte Creek. Western Canal Main Dam also



Western Canal Dam before and during removal



diverted Butte Creek water for agriculture. Both dams had fish ladders, but they were antiquated. Western Canal Main, Western Canal East Channel, McGowan, and McPherrin dams were removed in 1998 at a cost of \$9.5 million. Point Four Dam was removed in 1993 at a cost of \$365,000. Funding sources included the Anadromous Fish Restoration Program (Central Valley Project Improvement Act), the Ecosystem Restoration Program (CALFED Bay-Delta Program Category III), Four Pumps Mitigation Fund, WCWD, and California Urban Water Agencies. The project removed barriers and modified water diversion and conveyance facilities to restore 25 miles of Butte Creek to unimpeded flow for the first time since the 1920s. This was done while maintaining full water deliveries.

Additional Butte Creek fish passage improvement projects built or replaced defunct fish ladders at other dams, including:

- Parrott-Phelan Fish Screen and Fish Ladder Project (1994)
- Durham Mutual Fish Ladder and Fish Screen Project (1996)
- Rancho Esquon Partners Fish Ladder and Fish Screen Project (1996)
- Gorrill Ranch Fish Ladder and Fish Screen Project (1996).

Benefits of the restoration work have already been seen. The number of adult spring-run spawners increased from 14 in 1987 to 20,000 in 1998.

Centerville and Butte Creek head dams (PG&E hydropower dams upstream of the Butte Creek restoration project) have been considered for removal or modification, but there are unresolved issues about modification of downstream natural barriers and concerns about restrictions on land-use activities should ESA-listed anadromous fish gain access to the upper watershed.

For more information, contact:

- Paul Ward, DFG. (530) 895-5015. E-mail: pward@dfg2.ca.gov
- Olin Zirkle, Ducks Unlimited. 3074 Gold Canal Drive, Rancho Cordova, CA 95670. (916) 852-2000. E-mail: ozirkle@ducks.org
- Kevin Dossey, DWR. (530) 529-7362. E-mail: dossey@water.ca.gov

For more information about Butte Sink projects, contact:

- Rob Capriola, California Waterfowl Association. 132-B North Enright Ave., Willows, CA 95988. (530) 934-9182. E-mail: robcap@inreach.com

Butte Creek Restoration

Restoration of Butte Creek has begun with several restoration plans with varying objectives. Included are:

- **Upper Sacramento River Fisheries and Riparian Habitat Management Plan** (SB 1086), January 1989, with the stated goal "... to protect, restore, and enhance the fish and riparian habitat and associated wildlife of the upper Sacramento River" and tributaries.
- **Central Valley Salmon and Steelhead Restoration and Enhancement Plan** (SB 2261), April 1990, with the stated goals to " (1) restore all depleted salmon and steelhead habitat to a condition capable of sustaining population goals; (2) at least double the natural salmon production by the year 2000; (3) develop an annual steelhead run in the Sacramento River system of 100,000 fish; (4) ensure proper mitigation and compensation of existing projects that have resulted in resource loss or which are continuing to cause resource damage; (5) ensure that future projects either avoid adverse impacts to salmon and steelhead and their habitats or provide compensation where impacts cannot be avoided; and (6) enhance the quality of fishing opportunities for inland sport, ocean sport, and commercial users and maintain populations at levels capable of supporting sustained year-round angling opportunities."
- **Restoring Central Valley Streams: A Plan for Action**, November 1993, with the stated goal " ... to restore and protect California's aquatic ecosystems that support fish and wildlife and to protect threatened and endangered species."
- **Revised Draft Restoration Plan for the Anadromous Fish Restoration Program** (CVPIA AFRP), May 1997, with the stated goal to "... implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991."
- **CALFED Bay-Delta Program Ecosystem Restoration Program**, July 2000, with the stated goal to "... restore ecosystem health and improve water management for beneficial uses of the Bay-Delta system."

Each of the following actions, listed generally in order of implementation, has been completed or is in progress in the Butte Creek watershed and has been implemented under the general goals and objectives of the above restoration plans.

Parrott-Phelan Diversion

1. **Name:** Parrott-Phelan Fish Screen and Fish Ladder Project.

2. **Total Project Budget:** \$891,591 (Screen: DFG Prop. 70, \$64,500; M&T Chico/Llano Seco Ranches \$64,500) (Ladder: DFG, WCB, CVPIA and Four Pumps \$756,591)
3. **Total Spent to Date:** \$891,591
4. **Stakeholder Groups/Agencies:** M&T Chico Ranch, Llano Seco Ranch, USFWS, DFG.
5. **Project Start Date:** 1994
6. **Project Goals and Objectives:** Provide adequate passage for juvenile and adult anadromous fish.
7. **Current Status:** The fish ladder and screen are currently being operated and maintained by M&T Chico Ranch. Also, each of the structures is being used by resource agencies for technical analysis of structures and biological analyses of life history patterns of anadromous fish. The information generated has and is being used in the development and implementation of structures in other watersheds and to better define life history patterns of anadromous fish throughout their entire migratory range.
8. **Future Actions:** Land acquisition and riparian restoration is being implemented on lands adjacent to the project owned by both the M&T Chico Ranch and DFG.

Parrott-Phelan Diversion:

1. **Name:** M&T Pumps Water Exchange
2. **Total Project Budget:** \$4,600,000 for pump relocation and screening on Sacramento River. Water exchange was not valued but was M&T Chico/Llano Seco Ranch's contribution to project cost.
3. **Total Spent to Date:** same as above
4. **Stakeholder Groups/Agencies:** M&T Chico and Llano Seco Ranches, DFG, USFWS, USBR, SWRCB, Butte County Superior Court (adjudication), DWR.
5. **Project Start Date:** 1996.
6. **Project Goals and Objectives:** Provide adequate flows in Butte Creek for anadromous fish.
7. **Current Status:** Water exchange agreement with USBR is currently being completed and will eventually result in a SWRCB permanent designation for instream use. Water exchange involves respective ranches leaving 40 cfs in Butte Creek (primarily west branch of Feather River water) from October to June, in exchange for the right to divert equal volume from Sacramento River at M&T Pumps.
8. **Future Actions:** Completion of water right agreements with USBR, SWRCB, Butte County Superior Court (adjudication). Potential additional water acquisitions at the Parrott-Phelan diversion site to provide ultimate minimum base flow.

Western Canal Diversions

1. **Name:** Western Canal Siphon Project
2. **Total Project Budget:** \$9,700,000. (Initial planning: WCWD \$150,000; DFG Tracy Mitigation \$150,000) (Implementation: WCWD \$3,133,000; CVPIA \$3,133,000; Cat. III Met. \$3,133,000)
3. **Total Spent to Date:** \$9,700,000

4. **Stakeholder Groups/Agencies:** Western Canal Water District, Gorrill Ranch, McGowan Ranch, McPherrin Ranch, USBR, DFG, USFWS, DWR.
5. **Project Start Date:** 1992
6. **Project Goals and Objectives:** Provide adequate fish passage at McPherrin, McGowan, Western Canal (2 dams) by removing respective dams from Butte Creek.
7. **Current Status:** Siphon installation and dam removals were completed during 1998. Butte Creek flows legally diverted at the sites where the dams were removed have either been dedicated for instream use or moved to the Gorrill Diversion site. The Western Canal Water District provided alternate sources of water to all diverters previously utilizing the four structures.
8. **Future Actions:** None

Western Canal Diversion Water Rights

1. **Name:** Western Canal Project Water Rights Acquisition
2. **Total Project Budget:** Included in Western Canal Siphon and Gorrill Diversion Fish Ladder and Fish Screen Projects.
3. **Total Spent to Date:** Same
4. **Stakeholder Groups/Agencies:** Western Canal Water District, Gorrill Ranch, Alma Ryan, Jim Mcalister, DFG, Butte County Superior Court (Adjudication), DWR.
5. **Project Start Date:** 1992 (Part of overall Western Canal Siphon Project)
6. **Project Goals and Objectives:** Provide base instream flows of 10 cfs July through September below the Gorrill Diversion site.
7. **Current Status:** Currently implemented and within the responsibility of the DWR Butte Creek Watermaster.
8. **Future Actions:** None.

Point Four Diversion

1. **Name:** Point Four Dam Removal Project.
2. **Total Project Budget:** \$365,000 (WCWD \$235,000; DFG Prop. 70, \$130,000)
3. **Total Spent to Date:** \$365,000
4. **Stakeholder Groups/Agencies:** Point Four Ranch, Western Canal Water District, DFG, DWR.
5. **Project Start Date:** 1991
6. **Project Goals and Objectives:** Provide adequate fish passage at Point Four Dam.
7. **Current Status:** Dam was removed in 1993 and an alternate source of water provided to the diverter via the Western Canal Water District.
8. **Future Actions:** Possible relocation of original Butte Creek water right for the benefit of fish and wildlife.

Durham Mutual Diversion

1. **Name:** Durham Mutual Fish Ladder and Fish Screen Project.

2. **Total Project Budget:** \$935,441. (Initial Planning and design: DFG Tracy Mitigation \$66,000) (Implementation: CVPIA \$464,720; CALFED Cat. III. \$316,500; Four Pumps \$88,221)
3. **Total Spent to Date:** \$935,441.
4. **Stakeholder Groups/Agencies:** Durham Mutual Water Company, DFG, DWR, TNC, DU.
5. **Project Start Date:** 1996
6. **Project Goals and Objectives:** Provide adequate fish passage at Durham Mutual Diversion Dam.
7. **Current Status:** The fish ladder and screen, which were completed in 1998, are currently being operated and maintained by the Durham Mutual Water Company and are awaiting certification by AFSP technical team.
8. **Future Actions:** None.

Durham Mutual Dam Water Rights

1. **Name:** Durham Mutual Water Rights Acquisition Project.
2. **Total Project Budget:** Unknown
3. **Total Spent to Date:** Unknown
4. **Stakeholder Groups/Agencies:** Resource Renewal Institute, Butte County Superior Court (adjudication), SWRCB, Clarence Entler, Mary Roth, Bee Compton, DWR Butte Creek Watermaster.
5. **Project Start Date:** 1997
6. **Project Goals and Objectives:** Provide adequate flows in Butte Creek for anadromous fish
7. **Current Status:** Water rights to first priority Butte Creek flows (5 cfs April-September, 3 cfs October, 1.5 cfs November-March) were acquired by RRI for instream use. RRI is attempting to sell rights to USBR under CVPIA water acquisition program. RRI has filed under the Butte Creek Adjudication for dedication of acquired flows for instream use, and may file with SWRCB for similar dedication.
8. **Future Actions:** Potential acquisition of additional water rights at this site.

Adams Diversion

1. **Name:** Rancho Esquon Partners Fish Ladder and Fish Screen Project.
2. **Total Project Budget:** \$1,108,460. (Initial Planning and design: DFG Tracy Mitigation \$66,000) (Implementation: CVPIA \$520,897; Cat. III Met. \$520,897).
3. **Total Spent to Date:** \$1,108,460.
4. **Stakeholder Groups/Agencies:** Rancho Esquon Partners, DFG, DWR, DU.
5. **Project Start Date:** 1996
6. **Project Goals and Objectives:** Provide adequate fish passage at Adams Diversion.
7. **Current Status:** Project was completed during 1998, with subsequent modifications to the low-flow fish ladder completed in 1999. Technical analysis of performance has

been completed and is pending AFSP final certification. Fish ladder and fish screen are being operated and maintained by Rancho Esquon Partners.

8. **Future Actions:** DFG will closely monitor low-flow fish ladder for potential future modifications.

Gorrill Diversion

1. **Name:** Gorrill Ranch Fish Ladder and Fish Screen Project.
2. **Total Project Budget:** \$1,618,563. (Initial Planning and design: DFG Tracy Mitigation \$66,000) (Implementation: CVPIA \$755,949; Cat. III Met/Prop. 204 \$705,947).
3. **Total Spent to Date:** \$1,618,563.
4. **Stakeholder Groups/Agencies:** Gorrill Ranch, DFG, DWR, DU, WCWD.
5. **Project Start Date:** 1996.
6. **Project Goals and Objectives:** Provide adequate fish passage at Gorrill Diversion and consolidate Western Canal Water District's remaining Butte Creek water rights.
7. **Current Status:** The project was completed during 1998 and has been certified by AFSP technical team. Fish screen and fish ladders are being operated and maintained by Gorrill Ranch.
8. **Future Actions:** Potential need for flow monitoring station immediately below structure to manage instream flow acquisitions.

Sanborn Slough Bifurcation

1. **Name:** Bifurcation Sanborn Slough Water Control Structure Project.
2. **Total Project Budget:** \$1,070,000. (Initial Planning and design: USFWS AFRP \$70,000) (Implementation: USFWS Sacramento Refuge \$1,000,000).
3. **Total Spent to Date:** \$1,070,000
4. **Stakeholder Groups/Agencies:** CWA, DU, RD 1004, Eric Foraker, Butte Sink Waterfowl Association, USFWS, DWR, DFG.
5. **Project Start Date:** 1998.
6. **Project Goals and Objectives:** Provide adequate fish passage and water control at Sanborn Slough Butte Sink bifurcation.
7. **Current Status:** Stand-alone sub-project was completed as per total spent of \$1,070,000. Management agreement is currently being developed with primary management responsibility assigned to RD1004, in conjunction with Eric Foracre, and the Butte Sink Waterfowl Association.
8. **Future Actions:** Initial project funding was insufficient to complete as per final design. Additional funding (\$1,000,000) is currently being sought to complete additional phase of project.

MCAMIS Property Land Acquisition

1. **Name:** Butte Creek Ecological Preserve Honey Run Project.
2. **Total Project Budget:** \$546,067. (CALFED Cat. III \$186,128; NFWF \$132,439; USFWS AFRP \$125,000; WCB \$102,500)

3. **Total Spent to Date:** \$546,067
4. **Stakeholder Groups/Agencies:** CSUC Research Foundation, John McAmis, DFG, USFWS, BCWC.
5. **Project Start Date:** 1997
6. **Project Goals and Objectives:** Protect riparian corridor and aquatic habitat valuable to the restoration and survival of anadromous fish.
7. **Current Status:** The 90-acre McAmis property was acquired in 1998 and is contiguous with the DFG-owned Butte Creek Ecological Preserve Canyon and Virgin Valley Units which extend downstream to Highway 99. The CSUC Research Foundation has completed a MOU with DFG to assume management responsibility for entire Butte Creek Ecological Preserve and will use the McAmis (Honey Run Unit) for educational purposes in conjunction with CSUC.
8. **Future Actions:** Additional funding is being sought to initiate the first two years of management activities, after which it is anticipated that endowments funded by local donors and alumni will suffice.

Keeney Property Land Acquisition

1. **Name:** Butte Creek Preserve, Keeney Ranch
2. **Total Project Budget:** \$735,000 (USFWS AFRP)
3. **Total Spent to Date:** \$735,000
4. **Stakeholder Groups/Agencies:** The Center For Natural Lands Management, Butte County Fish and Game Commission, USFWS AFRP, CSUC Research Foundation, Keeney Ranch.
5. **Project Start Date:** 1997
6. **Project Goals and Objectives:** Protect riparian zone for the benefit of anadromous fish and other wildlife.
7. **Current Status:** The 56-acre Keeney property was acquired during 1997. The property is owned and managed by The Center for Natural Lands Management in partnership with the CSUC Foundation.
8. **Future Actions:** Completion of the management plan and riparian restoration is currently awaiting a permit from the State Reclamation Board. In conjunction with the Butte County Fish and Game Commission, approximately 15 acres will sold as a mitigation bank.

The Question of Structure Removal or Retention

About one-quarter of the 76,000 dams listed in the U.S. Army Corps of Engineers National Inventory of Dams were constructed during the 1960s and many structures are now a half-century old. By the year 2020, the Association of State Dam Safety Officials estimate that 80 percent of all dams will reach their design life (ASDSO 2001). The downstream hazard of dams, in the event of failure, is considered significant or high for over 30 percent of the dams in the NID database. Consequently, many dams are or will soon be in need of safety rehabilitation.

The costs for dam rehabilitation can sometimes exceed the economic return of a dam. With 75-90 percent of dams in private or local government ownership, rehabilitation and continued operation is sometimes financially infeasible.

Over 2,200 dams in the United States are for hydroelectric generation and the Federal Energy Regulatory Commission issues operating licenses for over 1,000 of these dams (FERC 2002). California, New York, Wisconsin and Maine collectively have over 36 percent of the hydroelectric dams requiring FERC licenses. By the year 2010, over a quarter of all FERC-licensed dams will need to be reissued a FERC license. Dam decommissioning is sometimes considered as an alternative during the relicensing process.

American Rivers has documented the removal of almost 500 structures, though the actual total is likely to be many more (Heinz 2002). The nation has many small dams that are abandoned or obsolete and whose owners may wish to consider removal as a viable option. Almost all dams removed have been small and privately owned. Reasons for dam removal include economic or structural obsolescence, safety, legal or financial liability, dam site restoration, ecosystem and watershed restoration, riparian and aquatic species habitat restoration, unregulated flow recreation, and water quality or quantity reasons.

Decision-making approaches about dam retention or removal include 1) establishing goals, objectives, and basis for the decision, 2) identifying major issues of concern, 3) assessing potential physical, biological, and economic and social indicators and outcomes, and 4) making decisions with a framework that encompasses costs and benefits, gains and losses, public support and concerns, and private and public interests. Data collection and assessment of outcomes such as likely future conditions are key components to each of these steps. This approach could be applied to any structure that obstructs fish migration. (The Heinz Center 2002; Trout Unlimited 2001)

Four key areas for consideration in any dam removal or retention project: physical environment, biological changes, economic aspects, and social aspects (The Heinz Center 2002).

Dam removal can restore some but not all of the physical characteristics of the river that existed before the dam was built, but that the most important positive outcome of dam removal is the reconnection of river reaches so that they can operate as an integrated system again. The extent of biological changes can depend on such things as the size of the dam (storage capacity), quantity and quality of sediment in the reservoir, and stability of the downstream river reach. (The Heinz Center 2002)

Dam removal may increase abundance and diversity of aquatic insect, fish and other populations; may destroy wetlands that existed in the reservoir but result in new wetlands downstream; or result in the replacement of one aquatic community with another by changing the environment from a lentic to lotic system. This may, therefore, create a partly natural and partly artificial population structure depending on species and resulting environmental conditions. The most significant biological benefit of removing a small structure is the increased accessibility of upstream habitat and spawning areas for migratory and anadromous fishes. (The Heinz Center 2002)

Traditional benefit-cost analysis (avoided costs of dam operation and external costs versus lost beneficial effects of dam operation) does not necessarily apply to dam removals because of the challenge of assigning monetary value for environmental losses or gains. While positives and negatives can be arrayed for various stakeholders, many environmental outcomes are uncertain or difficult to establish in monetary terms and adequately incorporate. (The Heinz Center 2002; Trout Unlimited 2001). Methods to quantify environmental benefits and costs have been under evaluation and development by the Corps of Engineers in a recent study, Multi-Objective Approaches to Floodplain Management on a Watershed Basis. More information on these economic evaluation methods and the study is available at <http://www.ecosystemvaluation.org/> and at <http://www.cop.noaa.gov/pubs/das/das5.html>.

Finally, the social context of dam removal decisions is often as important as the environmental and economic contexts. Social outcomes of dam removal include aesthetics of

the dam site, changed recreational opportunities, or loss of a historically significant structure or water body. Other issues may include property values, tribal rights, water quality, flood control, and maintenance of storage capability.

Dam removal decisions require careful planning and review. A removal project needs to be scientifically based taking into consideration specific economic and social contexts in planning process that are systematic, open and inclusive of the people in the affected communities.

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Appendix D: Evolutionarily Significant Units, Critical Habitat, and Essential Fish Habitat

The National Marine Fisheries Service (NMFS) administers the ESA for marine species and anadromous fish. The act requires NMFS to use the best scientific and commercial data available about species and populations and their habitats to designate threatened or endangered species under the ESA and to identify the habitat necessary for their survival. NMFS has grouped steelhead and Chinook salmon populations into ESUs based on two criteria: the population must be reproductively isolated, and it must represent an important component in the evolutionary legacy of the species. Habitat for endangered or threatened anadromous fish is designated as critical habitat under the ESA and as essential fish habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act. EFH has been designated for Chinook salmon, but not for steelhead.

Evolutionarily Significant Units

Steelhead along the West Coast are classified into 15 ESUs from Southern California to Canada and east to the Upper Columbia River drainage in Idaho. In California, five ESUs are listed: Northern California (threatened), Central California Coast (threatened), Central Valley (threatened), South-Central California Coast (threatened), and Southern California (endangered).

Likewise, Chinook salmon along the West Coast form 17 ESUs from Southern California to Canada and east to the Upper Columbia River drainage. In California, the Central Valley spring run is listed as threatened, and the Central Valley winter run is listed as endangered. One other California ESU, the Central Valley fall- and late-fall run of Chinooks, is designated as a candidate species.

Critical Habitat

The ESA requires NMFS to designate critical habitat when a species is listed as endangered or threatened. Critical habitat is a specific area occupied by a listed species that has the physical or biological features essential to conservation of the species, and it may require special management or protection. Essential features include spawning sites, juvenile rearing areas and migration corridors, adult migration corridors, food resources, water quality and quantity, and riparian vegetation. NMFS has designated critical habitat for Central California Coast, South-Central California Coast, Southern California, and Central Valley steelhead, and for Central Valley spring-run and Sacramento River winter-run Chinook salmon. In general, “critical habitat is designated to include all river reaches accessible to listed salmon or steelhead within the range of the ESUs listed...” (Federal Register 2000).

NMFS considers natural barriers and specific dams within the historical range of each ESU to be the upstream limit of a critical habitat designation. Critical habitat for the Central Valley spring run is based on U.S. Geological Survey (USGS) hydrologic unit codes specified in the Final Rule (Federal Register, Vol. 65, No. 32, 16 Feb 2000), and critical habitat for Sacramento River winter-run Chinook salmon is based on the Final Rule (Federal Register, Vol. 58, No. 114, 16 Jun 1993). Critical habitat for Central Valley and Central California Coast steelhead is based on USGS hydrologic unit codes specified in the Final Rule (Federal Register, Vol. 65, No. 32, 16 Feb 2000).

Essential Fish Habitat

The Sustainable Fisheries Act of 1996 (Public Law 104-267) requires fishery management plans for threatened or endangered species to describe and identify EFH. In the Central Valley, only Chinook salmon are covered by this requirement. The act defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (NMFS 2000).” The act requires federal agencies to consult with NMFS whenever something they do might adversely affect EFH. Private entities are not required to consult

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Appendix D: Evolutionarily Significant Units, Critical Habitat, and Essential Fish Habitat

with NMFS unless their activity is funded, permitted, or authorized by a federal agency and the project may adversely affect EFH. States are not required to consult with NMFS; however, NMFS is required to develop EFH conservation recommendations for any state agency activities that would impact EFH. Although the concept of EFH is similar to critical habitat of the ESA, measures recommended by NMFS or a regional fisheries management council to protect EFH are advisory, not prescriptive.

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Appendix D: Evolutionarily Significant Units, Critical Habitat, and Essential Fish Habitat

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Other Chapters

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Chapter 2. Solving the Problem

Chapter 3. Existing Habitat Conditions and Status of Fish Populations

Chapter 4. Current Program Activities

Appendix A Known Structures Within CALFED ERP Geographic Scope

Appendix B: Applicable Laws and Examples of Fish Passage Programs at Other Agencies

Appendix C: Structure Removal Examples and Challenges

Appendix D: Evolutionarily Significant Units, Critical Habitat, and Essential Fish Habitat

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